

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
15 November 2001 (15.11.2001)

PCT

(10) International Publication Number
WO 01/85034 A1

(51) International Patent Classification⁷: A61B 17/072, 17/064

(21) International Application Number: PCT/US01/14866

(22) International Filing Date: 9 May 2001 (09.05.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/568,012 10 May 2000 (10.05.2000) US

(71) Applicant (for all designated States except US): SCIMED LIFE SYSTEMS, INC. [US/US]; One Scimed Place, Maple Grove, MN 55311-1566 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): GEITZ, Kurt, A., E. [US/US]; 143 Maynard Road, Sudbury, MA 01776 (US).

(74) Agents: GARRETT, Arthur, S. et al.; FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P., 1300 I Street, N.W., Washington, DC 20005-3315 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

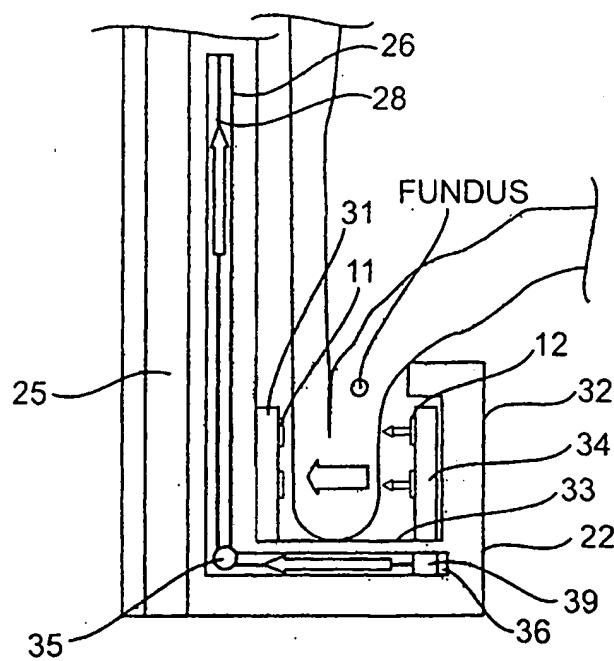
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: DEVICES AND RELATED METHODS FOR SECURING A TISSUE FOLD

WO 01/85034 A1



(57) Abstract: The present invention relates to devices and methods for creating and securing a tissue fold during an endoluminal medical procedure. The devices and methods may be used for folding and securing, for example, a fundus wall onto an esophagus wall. An aspect of the invention includes a two-piece tissue clip configured to be installed through an endoluminal device to secure a tissue fold. The clip includes a female member and a male member configured to engage one another to secure the tissue fold. Another aspect of the invention includes a clipping device comprising a tissue clip magazine. The magazine is configured to hold a plurality of tissue clips and install the plurality of tissue clips in a single actuation of the magazine. A method for using the clipping device together with the tissue clips of the present invention to create and secure a fold of tissue during an endoluminal procedure also is disclosed.

WO 01/85034 A1



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

-1-

DEVICES AND RELATED METHODS FOR SECURING A TISSUE FOLD
FIELD OF THE INVENTION

The present invention pertains to devices, and a method for using the devices, for creating and securing a tissue fold during an endoluminal procedure. More specifically, the invention relates to devices and methods 5 for folding, for example, a region of the stomach circumferential to the opening of the esophagus back onto the esophagus.

BACKGROUND OF THE INVENTION

Gastroesophageal reflux occurs when stomach acid enters the esophagus. This reflux of acid into the esophagus occurs naturally in healthy 10 individuals, but also may become a pathological condition in others. Effects from gastroesophageal reflux range from mild to severe. Mild effects include heartburn, a burning sensation experienced behind the breastbone. More severe effects include a variety of complications, such as esophageal erosion, 15 esophageal ulcers, esophageal stricture, abnormal epithelium (e.g., Barrett's esophagus), esophageal cancer, and/or pulmonary aspiration. These various clinical conditions and changes in tissue structure that result from reflux of stomach acid into the esophagus are referred to generally as Gastroesophageal Reflux Disease (GERD).

Many mechanisms contribute to prevent gastroesophageal reflux in 20 healthy individuals. One such mechanism is the functioning of the lower esophageal sphincter (LES). With reference to Figure 1, the LES is a region of smooth muscle and increased annular thickness existing in the last four centimeters of the esophagus. In its resting state, the LES creates a region of high pressure (approximately 15-30 mm Hg above intragastric pressure) at 25 the opening of the esophagus into the stomach. This pressure essentially closes the esophagus so that contents of the stomach cannot pass back into the esophagus. The LES opens in response to swallowing and peristaltic motion in the esophagus, allowing food to pass into the stomach. After opening, however, a properly functioning LES should return to the resting, or 30 closed state. Transient relaxations of the LES do occur in healthy individuals,

-2-

however, typically resulting in normal physiological functions such as belching and vomiting.

The physical interaction occurring between the gastric fundus and the esophagus also prevents gastroesophageal reflux. The gastric fundus is a
5 lobe of the stomach situated at the top of the stomach proximal to the esophagus. In healthy individuals, the fundus presses against the opening of the esophagus when the stomach is full of food and/or gas. This effectively closes off the esophageal opening to the stomach and helps to prevent acid reflux back into the esophagus.

10 In individuals with GERD, the LES functions abnormally, either due to an increase in transient LES relaxations, decreased muscle tone of the LES during resting, or an inability of the esophageal tissue to resist injury or repair itself after injury. More generally, GERD results from a change in the geometrical relationship between the esophagus and the fundus of the
15 stomach. Normally, the fundus extends above the exit of the esophagus into the stomach. Thus, as intra-abdominal pressure increases, the fundus pushes against the LES to assist in closing the LES. In people with GERD, the fundus flattens out so that it no longer assists in closing the fundus. Moreover, the LES tends to shorten from about 4 cm to about 2 cm in length.
20 GERD can also be caused by hiatal hernia, which also may potentially lead to a change in the geometric relationship as described above. These conditions often are exacerbated by overeating, intake of caffeine, chocolate or fatty foods, and/or smoking. Avoiding these exacerbating mechanisms helps reduce the negative side effects associated with GERD, but does not cure the
25 disease completely.

A surgical procedure, known generally as fundoplication, has been developed to prevent acid reflux in patients whose normal LES functioning has been impaired. Fundoplication involves bringing the fundus into closer proximity to the esophagus to help close off the esophageal opening into the
30 stomach. In Nissen Fundoplication, a particular type of the fundoplication procedure, the fundus is pulled up and around the esophagus and sutured both to itself and to the esophagus such that it completely encircles the

-3-

esophagus. Traditionally, this procedure has been performed as an open surgery, but has recently enjoyed success as a laparoscopic procedure, as discussed in McKernan, J.B., Champion, J.K., "Laparoscopic antireflex surgery," American Surgeon, Vol. 61, pp. 530-536, (1995).

5 As with any open surgery, the risks attendant in such a procedure are great. Due to relatively large incisions necessary in the performance of open surgery, relatively large amounts of blood are lost and risk of infection increases. Though laparoscopic surgical procedures reduce these negative effects by using relatively small devices at a relatively small incision site in the
10 abdominal wall, there still exists an increased risk of infection due to the incision. The location of the incision in the abdominal wall presents a risk of other negative effects, such as sepsis, which can be caused by leakage of septic fluid contained in the stomach. Furthermore, as with any surgery, there exists a small risk of morbidity and mortality associated with the use of
15 general anesthesia.

SUMMARY OF THE INVENTION

The advantages and purpose of the present invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The advantages
20 and purpose of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

The present invention includes devices, and related methods for using the devices, to fold and secure tissue during an endoluminal medical procedure. In particular, the inventive devices, and the methods for using the
25 devices, may be employed in Nipple Fundoplication procedures, a specific type of fundoplication procedure which will be described shortly, for the treatment of GERD. When used to perform, for example, Nipple Fundoplication, the inventive devices allow the procedure to be completed rapidly, repeatedly, and consistently without compromising safety or
30 increasing invasiveness.

To attain the advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, the invention includes a

-4-

device for securing a fold of tissue comprising a female member and a male member. The female member defines an aperture and the male member has an engaging member configured to pierce and extend through a fold of tissue. The the aperture and engaging member are configured so as to allow the

5 engaging member to pass through the aperture in a first direction when the female and male members are in a disengaged relationship and to restrict the engaging member from passing through the aperture in a second direction opposite to the first direction when the female and male members are in an engaged relationship.

10 Another aspect of the invention includes a clipping device for creating and securing a tissue fold. The clipping device includes a tube having a magazine disposed on its distal end. The magazine is configured to hold a plurality of tissue clips for installation to secure the tissue fold. An actuator, disposed at a proximal end of the shaft, actuates the magazine to

15 simultaneously install the plurality of tissue clips.

Yet another aspect of the invention includes a method for securing a tissue fold during an endoluminal medical procedure. The method includes providing a plurality of tissue clips configured to engage and secure a tissue fold, and providing a tissue clip magazine configured to hold the plurality of tissue clips. The method further includes inserting the tissue clip magazine using an endoluminal procedure into an area of the body where a tissue fold is to be secured. The magazine is then positioned proximal the tissue fold and actuated such that the plurality of tissue clips are simultaneously installed with respect to the tissue fold.

20 It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute

30 a part of this specification, illustrate the preferred embodiments of the invention and, together with the description, serve to explain the principles of the invention. In the drawings,

-5-

Figure 1 is a cross-sectional view of the gastrointestinal tract from a mid-point of the esophagus to a point near the beginning of the duodenum;

Figure 2 is a perspective view of a respective female member and male member that form a tissue clip according to an embodiment of the 5 present invention;

Figures 3a-3c are respective side, front, and rear views of an embodiment of a clipping device according to the present invention;

Figure 4 is a cross-sectional view taken through plane A-A' in Figure 3b showing details of the internal structure of the embodiment of the clipping 10 device according to the present invention;

Figure 5a is cross-sectional side view of an embodiment of the clipping device with tissue clips inserted according to the present invention;

Figure 5b is a cross-section view of Figure 5a taken through line B-B';

Figure 6 is a cross-sectional side view of the clipping device of Figure 15 5a, with an upward force exerted on the cable to move a sliding clip holder toward a stationary clip holder;

Figure 7 is a cross-sectional side view of the clipping device of Figure 5a after the female and male members of the tissue clip have been engaged to secure the tissue fold and the upward force has been released to cause 20 the sliding clip holder to spring back into its original position;

Figure 8 is a side view of an embodiment of the clipping device of the present invention shown inserted into the stomach through the esophagus with an endoscope fed through the endoscope lumen to provide vision and the tissue clip magazine shown in position to form the tissue fold of the 25 fundus onto the esophagus; and

Figure 9 is a cross-sectional view of a portion of the esophagus and stomach shown with tissue clips installed in a semi-circular array to secure the fold of tissue created between the fundus and the esophagus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 A newly developed form of fundoplication, referred to as Nipple Fundoplication, is an endoluminal procedure in which the fundus is folded back onto the esophagus. The tissue fold formed between the esophagus

-6-

and fundus is then secured. Nipple Fundoplication is intended to be performed as an endoluminal procedure, with insertion of required medical instruments occurring through the esophagus. Such a procedure has the benefits of being less invasive, quicker, and less expensive as compared to
5 previous techniques.

As with most endoluminal procedures, preferably, completion of Nipple Fundoplication occurs as rapidly as possible without compromising the safety or non-invasiveness of the procedure. To maintain the procedure as relatively non-invasive, it is preferable to provide a device, and method for
10 using the device, that is small in size, yet has the capability to secure the fundus to the esophagus in a plurality of locations during a single insertion and with consistent results.

The various aspects of this invention pertain generally to a tissue clip and a clipping device for installing the tissue clip to create and secure a tissue
15 fold during an endoluminal procedure. The devices, and methods for their use, are particularly suited for performing the Nipple Fundoplication procedure described previously. Using the inventive devices to secure the fundus to the esophagus in Nipple Fundoplication allows the procedure to be performed rapidly and relatively non-invasively, and results in a substantially
20 uniform tissue fold.

To accomplish these objectives, the present invention includes a tissue clip and a clipping device adapted to position the tissue clip to secure the fold of tissue created during the endoluminal procedure. Additionally, the present invention includes a method for using the tissue clip and the clipping device.
25 Although, the inventive devices will be discussed mainly with reference to their use in securing a fundus wall to an esophagus wall in a Nipple Fundoplication procedure, the devices can be used in conjunction with other medical procedures that require creating and securing tissue folds. Moreover, the devices may be used in other settings, including industrial
30 settings, that require the securing of two surfaces together in an environment having limited access to the two surfaces.

A preferred embodiment of a tissue clip 10 according to the present invention is shown in Figure 2. Tissue clip 10 includes two members, a female member 11 and a male member 12. Members 11 and 12 essentially have plate-shaped configurations, shown as square plates in the Figure.

- 5 Female member 11 includes an X-shaped aperture 13 disposed substantially in the center of the member and extending through its thickness. Male member 12 includes an engaging member 14 disposed substantially in the center of male member 12 and extending perpendicularly from its surface. Engaging member 14 includes a stem portion 15 and a head portion 16
- 10 extending from stem portion 15. Head portion 16 has a tapered shape, with the widest part of the taper closest to the stem. Aperture 13 and engaging member 14 are sized and shaped to allow engaging member 14 to pass through aperture 13 when female member 11 and male member 12 start from a disengaged relationship. Once engaging member 14 has passed through
- 15 aperture 13 such that female member 11 and male member 12 are in an engaged relationship, head portion 15, at the widest part of the taper, abuts the surface of member 11 surrounding aperture 13. Thus engaging member 14 cannot pass back through aperture 13 in a direction opposite to the direction it passed through initially.
- 20 Tissue clip 10 can be made of any suitable material that is biocompatible, such as polyethylene, teflon, or titanium. However, due to the high mobility of the LES and the concomitant incidence of implant migration, it is more preferable to use materials that are bioabsorbable, such as, polydioxanone, poly e-caprolactone, polylactic acid, polyglycolic acid or
- 25 poly(DL-lactide-co-glycolide), or combinations or mixtures thereof. When a bioabsorbable material is used to make tissue clip 10, it is contemplated that eventually adhesions will form between the tissue on the esophagus wall and the fundus wall such that external securing means, such as the clip, are unnecessary. Thus, the bioabsorbable material should be selected such that
- 30 disintegration of the clip occurs after the tissue has had an opportunity to fully adhere.

-8-

In general, tissue clip 10 has dimensions that allow it to be used with endoluminal devices and for the purposes of securing the fold created during a fundoplication procedure. A preferred form of tissue clip 10 has dimensions that prevent ischemia of the tissue between the clip plates while still enabling
5 it to be inserted and installed using a clipping device 20 according to the present invention, which will be discussed shortly. The plates forming tissue clip 10 each have a length of approximately 1 cm and a width of approximately 5 mm. Additionally, engaging member 14 must have a length that enables it to extend through the entire thickness of the tissue fold to be
10 secured.

As mentioned previously, tissue clip 10, shown in the embodiment of Figure 2, has an essentially square shape. However, the clip can have other shapes and the male and female members need not have the same shape. In fact, to avoid piercing of the tissue and subsequent migration, it is preferred
15 to use a clip with rounded corners. Also, the embodiment shown has only a single aperture and a single engaging member that engage with one another. The scope of the invention includes any number of engaging members and apertures to secure the male and female members together. The number may be chosen based on factors such as, for example, the shape of the
20 members, the size of the members, the thickness of the tissue to be folded, the area of the folded tissue to be secured, and other similar factors, and it has been found that two engaging members and two apertures are preferred to fix the position of the clip and to better resist migration.

An embodiment of a clipping device according to the present invention
25 and adapted for use with the inventive tissue clip described above is shown in Figures 3-7. External side, front, and rear views of a clipping device 20 are shown in Figures 3a-3c, respectively. The embodiment of clipping device 20 generally includes a tube 21 and a tissue clip magazine 22 on a distal end of tube 21. Tissue clip magazine 22 is configured to hold tissue clips 10 during
30 insertion and installation of the clips to secure the tissue fold. Tissue clip magazine 22 preferably has a substantially hollow semi-circular shape to facilitate insertion into the cylindrical shape of the esophagus. As shown in

-9-

Figure 3c, a back portion 23 of tissue clip magazine 22 is open so that tissue clips may easily be inserted into the magazine. Tissue clip magazine 22 also includes an opening 24 in the top of the magazine so that the fold of tissue can be seated within the magazine during installation of the tissue clip.

5 magazine 22 engages tube 21 such that tube 21 lies substantially flush with back portion 23.

Figure 4 illustrates details of the structure of clipping device 20, as seen from a cross-sectional perspective taken through plane A-A' in Figure 3b, looking down toward a base of tissue clip magazine 22. As shown, tube 21

10 includes three lumens that extend longitudinally through tube 21. Specifically, tube 21 includes an endoscope lumen 25 for receiving an endoscope to provide vision into the body during use of clipping device 20. A cable lumen 26 also is provided in tube 21 for feeding a cable 28 (see Figure 5) from an actuating mechanism (not shown), such as a spool with a knob to take up the cable, at a

15 proximal end of tube 21 to a pulley-slider track system at the distal end. The third lumen in tube 21 is a vacuum supply lumen 27 which is in fluid communication with a vacuum source (not shown) at a proximal end of clipping device 20 and with suction ports 29 disposed on base 30 of tissue clip magazine 22. Sealed ducts (not shown), disposed below base 30, create a fluid

20 communication between vacuum supply lumen 27 with suction ports 29.

Tissue clip magazine 22 includes a plurality of stationary holders 31 at base 30 of the magazine for holding one of the female and male members 11, 12 forming the tissue clip. In the embodiment shown in Figure 4, three stationary holders 31 are disposed at substantially equidistant angular intervals around tube 21. Slider tracks 33 extend radially along base 30 from tube 21 to an outer wall 32 of magazine 22. Each slider track 33 engages a sliding clip holder 34, shown in Figure 5a, at its end opposite to the end engaging a stationary clip holder 31. As mentioned previously, base 30 further includes a plurality of suction ports 29, preferably disposed on both sides of each slider

25 track 33 between tube 21 and outer wall 32. The scope of invention is not limited to any particular number or arrangement of slider tracks or suction ports.

30

-10-

Any number or arrangement of slider tracks and ports can be provided depending on the desired results in securing the tissue fold.

A cross-sectional view taken from the side of clipping device 20 is shown in Figure 5a. In this Figure, tissue clips 10 are shown loaded into tissue clip magazine 22. Only one set of tissue clips, clip holders (stationary and sliding), and slider track is shown in Figure 5a, however the remaining sets that are not shown are configured and operate in the same manner. Similarly, due to the perspective of the cross-section shown in the Figure, only endoscope lumen 25 and cable lumen 26 are shown. Tissue clips 10 are loaded in magazine 22 with one of the female and male members 11 and 12, respectively, engaged with stationary clip holder 31 and the other engaged with sliding clip holder 34. The clips can be held in pockets created in the clip holders, with the pockets carrying a plurality of fingers that are configured to form an interference fit with the tissue clip plates. Preferably, female member 11 engages with stationary clip holder 31 and male member 12 engages with sliding clip holder 34, as shown in the embodiment of Figure 5a. Tissue clip magazine 22 preferably has a depth large enough to hold a plurality of tissue clip members stacked on top of each other. In a preferred form of the invention, each pair of clip holders (i.e. stationary clip holder 31 and sliding clip holder 34) holds two tissue clips 10, i.e. two female members 11 disposed one over the other and two male members 12 disposed one over the other. In the specific embodiment shown, the tissue clip magazine may install six tissue clips in a single insertion and actuation of clipping device 20. More or less tissue clips may be installed in a single actuation depending on the specific construction of the magazine and clip holders.

With reference to Figure 5b, the engagement of sliding clip holder 34 and slider track 33 will now be explained. Figure 5b is a cross-sectional perspective of tissue clip magazine 22 and sliding clip holder 34 taken from line B-B' in Figure 5a. As shown in Figure 5b, sliding clip holder 34 includes a narrow portion 38 at its base that is configured to fit snugly within slider track 33. Preferably, the slider track and the narrow portion either are made of, or are lined with, materials that reduce friction between the contacting surfaces to permit smooth movement of sliding clip holder 34 along slider track 33. Slider

-11-

track 33 opens below base 30 into a channel 36 having a width wider than slider track 33. A channel-engaging member 39 depends from narrow portion 38 of sliding clip holder 34 and is moveably disposed within channel 36. As with slider track 33 and narrow portion 38, preferably, the materials selected for channel 36 and channel-engaging member 39 should minimize frictional effects.

5 Referring again to Figure 5a, cable 28 extends from a proximal end of clipping device 20 through cable lumen 26 to a pulley 35 disposed between cable channel lumen 26 and channel 36. From pulley 35, cable 28 extends through channel 36 and connects to channel-engaging member 39.

10 10 Preferably, cable 28 branches into a plurality of cables, for example, one for each channel. Each of the branched plurality of cables in turn connects respectively to each of a plurality of pulleys provided in each channel. Thus, as an upward force is exerted on cable 28, shown by the vertical arrow in Figure 6, pulley 35 rotates and the branch of cable 28 within channel 36 pulls

15 15 channel-engaging member 39 through channel 36, imparting motion to sliding clip holder 34 along slider track 33. Channel-engaging member 39 attaches to a spring 37 on a side opposite to where cable 28 attaches, shown in Figure 7. Thus, release of the upward force on cable 28 causes sliding clip holder 34 to spring back into its original position near outer wall 32 of tissue clip magazine

20 20 22. Female members 11 and male members 12, once secured through the tissue fold to one another, are held together with a force sufficient to cause them to be released from the interference fit with the fingers of clip holders 31 and 34 as the clip holders are pulled away from members 11 and 12.

Using the embodiments of clipping device 20 and tissue clips 10
25 25 according to the present invention described above, the fundoplication procedure is performed in the following manner. Clipping device 20 is loaded with six tissue clips at the three substantially evenly-spaced angular locations around the semi-circle formed by tissue clip magazine 22, as described above with reference to Figure 4. The loaded clipping device 20 is then inserted
30 30 through the esophagus into the stomach. Referring to Figure 8, an endoscope 40, fed through endoscope lumen 25, provides vision to the stomach so that

-12-

tissue clip magazine 22 can be positioned in the region of the fundus to be folded and secured to the esophagus.

During the positioning of tissue clip magazine 22, a vacuum source, connected to vacuum lumen 27, creates a suction at suction ports 29 due to the 5 fluid communication provided by the ducts as discussed above. With the vision provided by endoscope 40, clipping device 22 is pulled upward toward the region of the fundus wall to be secured. As clipping device 22 is pulled upward, the suction provided by suction ports 29 draws the fundus wall and the esophagus wall toward base 30 of tissue clip magazine 22. Once these walls 10 have been drawn into tissue clip magazine 22 to create a tissue fold, an actuating mechanism connected to cable 28 at the proximal end of cable lumen 25 operates to pull cable 28 upward. As a result of this force, cable 28, connected to channel-engaging member 39, pulls member 39 through channel 36, moving sliding clip holder 34 along slider track 33 toward stationary clip 15 holder 31. As sliding clip holder 34 moves toward stationary clip holder 31, engaging members 14 eventually pass through apertures 13 to form engaged tissue clips 10 to secure the tissue fold. The force exerted on cable 28 is large enough to enable engaging members 14 to pierce the thickness of the tissue fold and be driven through apertures 13 in female member 11. The actuating 20 mechanism provided to create the upward force on cable 28 can be a handle that is turned manually, an automatic winding reel, or other suitable like actuators known to those skilled in the art.

After clipping device 20 has been actuated and tissue clips 10 have been formed, a tissue fold secured at angular positions around the esophagus results, 25 as shown in Figure 9. The uniform depth of tissue clip magazine 22, and the uniform spacing (both radially and vertically) of tissue clips 10, results in a tissue fold that is secured uniformly and quickly in a single insertion of the endoluminal device.

After tissue clips 10 have been installed, the force on cable 28 is 30 removed and sliding clip holders 34 spring back into their original position, releasing male members 12. Clipping device 20 can then be removed from the stomach. Tissue clips 10 remain to secure the fundus wall to the esophagus

-13-

wall preferably until natural adhesion of the two tissues occurs. A sclerosing agent can be injected onto the tissue fold to facilitate the natural adhesion process. Eventually and preferably, tissue clips 10 disintegrate and fall away from the naturally-adhered fold.

5 It will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein that various modifications and variations can be made in both the tissue clip and the clipping device of the present invention. For example, the tissue clip, and the tissue clip magazine for holding the tissue clip, may be provided in different sizes, such as, 10 for example, small, medium, and large, for use with children, average-sized, and larger patients, respectively. However, it is important that the entire device be configured to fit in the esophagus, or other part of the body, depending on the particular endoluminal procedure being performed. Additionally, the number of tissue clips used to secure the tissue fold may be altered and the tissue clip 15 magazine may be altered accordingly to house a different number of clips in both the radial and vertical directions. In addition, additional lumens may be provided in the tube so that additional devices may be inserted onto the esophagus and stomach to perform additional operations.

The particular use of both the tissue clip and the clipping device in conjunction with a Nipple Fundoplication procedure is illustrative only. It is considered to be within the scope of this invention to use these devices with other endoluminal procedures, as well as for purposes outside of the medical industry that may require insertion and installation of fasteners through small spaces.

25 Therefore, the invention in its broader aspects is not limited to the specific details and illustrative examples shown and described in the specification. It is intended that departures may be made from such details without departing from the true spirit or scope of the general inventive concept as defined by the following claims and their equivalents.

-14-

WHAT IS CLAIMED IS:

1. A device for securing a fold of tissue, comprising:
 - a female member defining an aperture therein; and
 - a male member having an engaging member configured to pierce and

5 extend through a fold of tissue,
wherein the aperture and engaging member are configured so as to allow
the engaging member to pass through the aperture in a first direction when the
female and male members are in a disengaged relationship and to restrict the
engaging member from passing through the aperture in a second direction

10 15 10 opposite to the first direction when the female and male members are in an
engaged relationship.

2. The device of claim 1, wherein the engaging member includes a
stem portion and a head portion, the head portion engaging with a portion of the
female member surrounding the aperture so that the engaging member cannot
pass through the aperture in the second direction.

3. The device of claim 2, wherein the head portion includes a tapered
shape with a widest portion of the tapered shape adjacent the stem portion of
the engaging member.

4. The device of claim 2, wherein the aperture has an X-shaped
20 configuration.

5. The device of claim 1, wherein the male and female members are
comprised of bioabsorbable material.

6. The device of claim 1, wherein the male and female members are
configured to be installed to secure the tissue fold during an endoluminal
25 procedure.

7. A clipping device for securing a tissue fold, comprising:
 - a tube having an actuator; and
 - a magazine disposed on a distal end of the tube, said magazine

30 configured to hold a plurality of tissue clips for installation to secure the tissue
fold, wherein actuation of the actuator simultaneously installs the plurality of
tissue clips.

8. The clipping device of claim 7, wherein the tube and the magazine

-15-

are configured to be inserted through an esophagus into a stomach to install a plurality of tissue clips to secure a fundus wall to an esophagus wall.

9. The clipping device of claim 7, wherein the magazine includes a stationary clip holder and a sliding clip holder disposed substantially opposite to each other.

10. The clipping device of claim 9, wherein the magazine further includes a slider track configured to guide the sliding clip holder toward the stationary clip holder.

11. The clipping device of claim 9, wherein the actuator imparts motion to the sliding clip holder.

12. The clipping device of claim 9, wherein each of the plurality of tissue

clips is comprised of a female member and a male member, wherein each female member and male member are configured to engage with one of the 15 sliding clip holder and the stationary clip holder, and wherein motion of the sliding clip holder toward the stationary clip holder causes the male member to engage the female member to engage each other and form the tissue clip.

13. The clipping device of claim 12, wherein the magazine includes a plurality of stationary clip holders and sliding clip holders disposed at a plurality 20 of angular intervals around a longitudinal axis of the magazine.

14. The clipping device of claim 12, wherein each of the stationary clip holder and the sliding clip holder are configured to hold a plurality of respective female and male members forming the tissue clip.

15. The clipping device of claim 10, wherein the slider track extends 25 along a base of the magazine from the tube to an outer wall of the magazine.

16. The clipping device of claim 9, wherein the actuator includes a cable.

17. The clipping device of claim 16, wherein the cable connects to the sliding clip holder.

30 18. The clipping device of claim 9, further comprising a biasing member connected to the sliding clip holder.

-16-

19. The clipping device of claim 7, wherein the tube includes a lumen configured to receive an endoscope.
20. The clipping device of claim 7, wherein the magazine defines at least one suction port therein.
- 5 21. The clipping device of claim 20, wherein the magazine defines an opening configured to receive a tissue fold.
22. The clipping device of claim 21, wherein the suction port is in fluid communication with a vacuum lumen disposed in the tube.
- 10 23. A method for securing a tissue fold during an endoluminal medical procedure:
 - providing a tissue clip magazine holding a plurality of tissue clips configured to engage and secure a tissue fold;
 - inserting the tissue clip magazine endoluminally into an area of the body where a tissue fold is to be secured;
 - 15 positioning the tissue clip magazine proximal the tissue fold;
 - actuating the tissue clip magazine to simultaneously engage the tissue fold with the plurality of tissue clips.
24. The method of claim 23, wherein the tissue clip magazine is inserted through an esophagus into a stomach and the tissue fold includes a fundus wall and an esophagus wall.
- 25 25. The method of claim 23, wherein providing the tissue clip magazine includes providing a stationary clip holder and a sliding clip holder disposed substantially opposite to each other.
26. The method of claim 25, wherein actuating the magazine includes moving the sliding clip holder toward the stationary clip holder.
27. The method of claim 26, wherein each tissue clip includes a male member and a female member each engaged with one of the stationary clip holder and the sliding clip holder, and moving the sliding clip holder causes the male and female members to engage each other.
- 30 28. The method of claim 27, wherein the tissue clip magazine includes a plurality of sliding clip holders and corresponding stationary clip holders disposed about a longitudinal axis of the magazine.

-17-

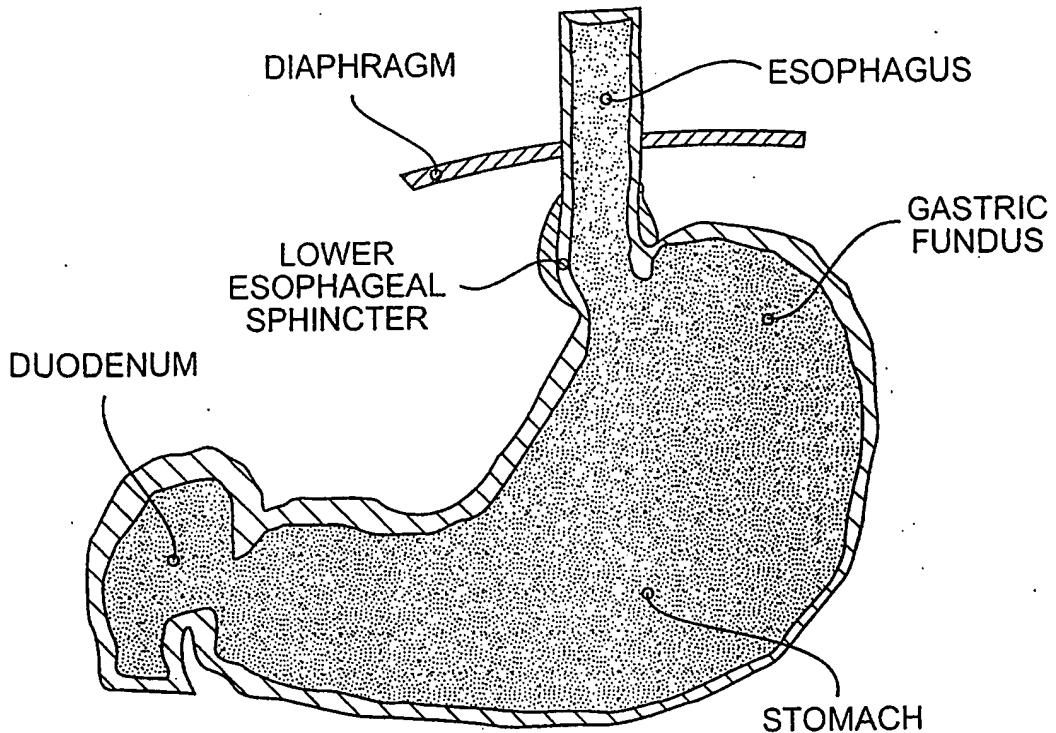
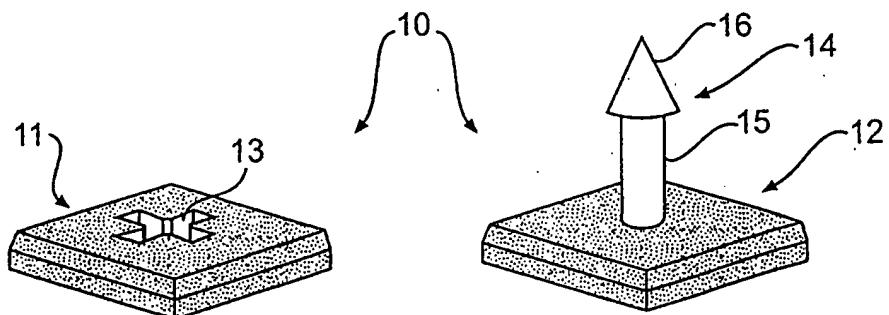
29. The method of claim 28, wherein actuating the magazine includes exerting a force on an actuator to move the sliding clip holder along a track disposed along a base of the magazine.

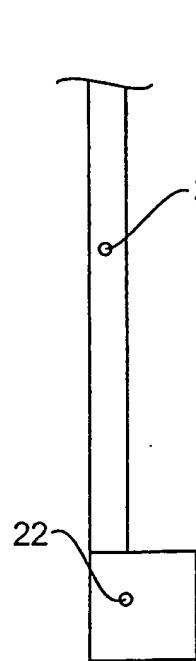
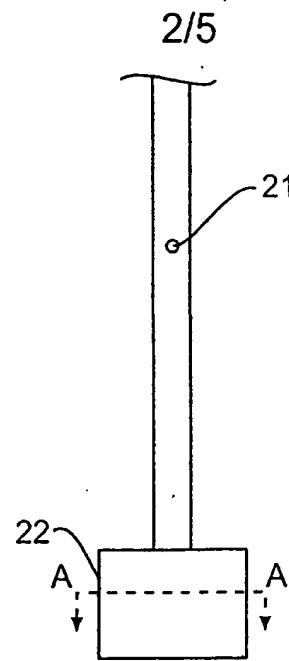
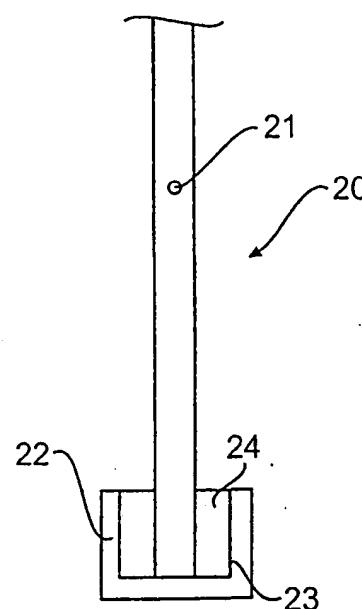
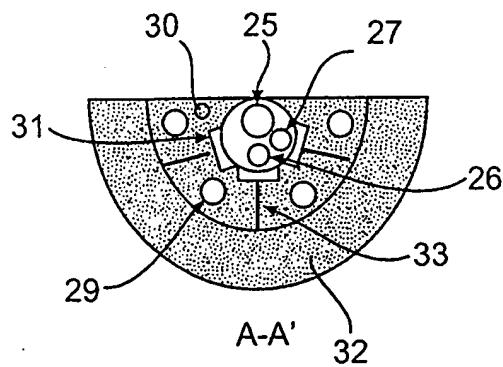
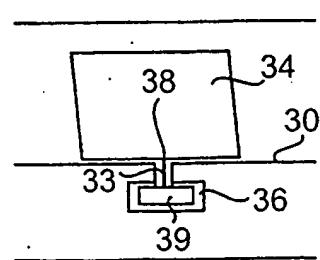
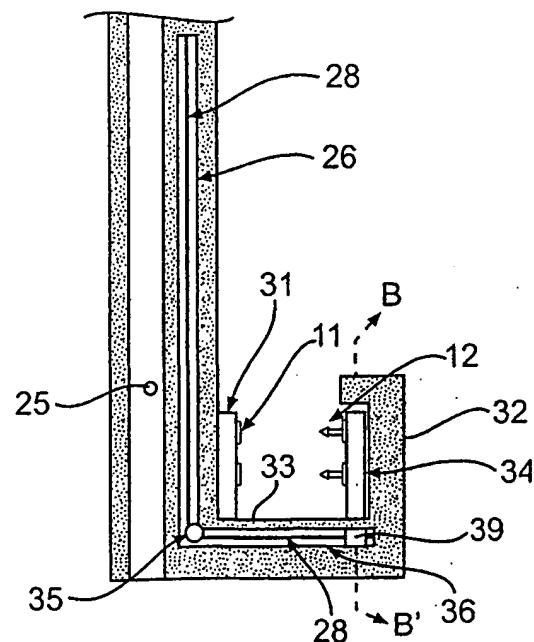
30. The method of claim 23, wherein providing the tissue clip
5 magazine includes disposing the magazine on a distal end of a tube, the tube including a lumen configured to receive an endoscope.

31. The method of claim 23, further comprising inserting the tissue of the tissue fold into an opening in the tissue clip magazine.

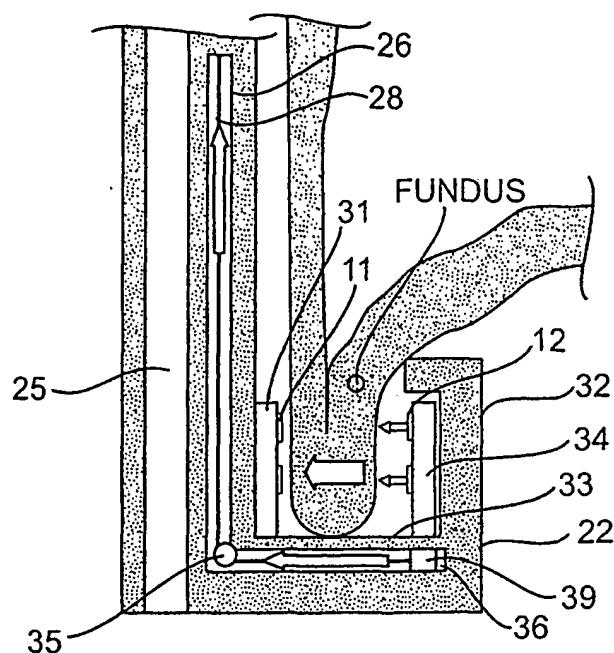
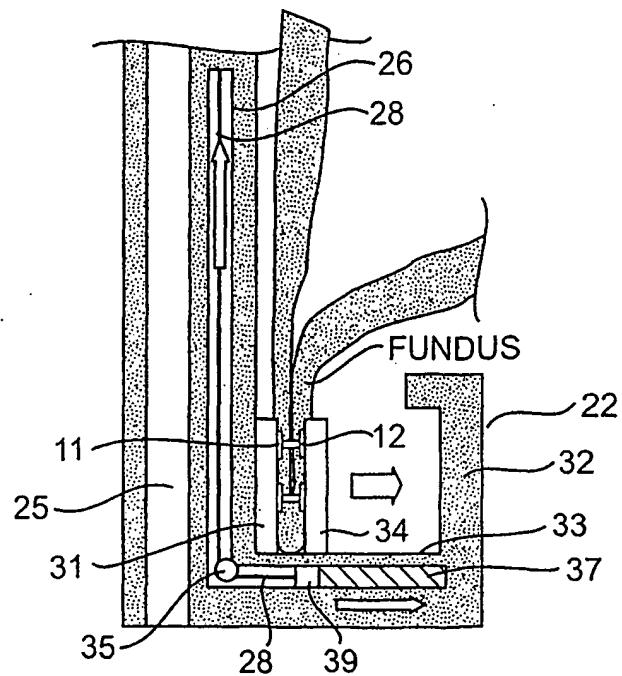
32. The method of claim 31, wherein inserting the tissue fold includes
10 drawing the tissue of the tissue fold into the opening by suction.

1/5

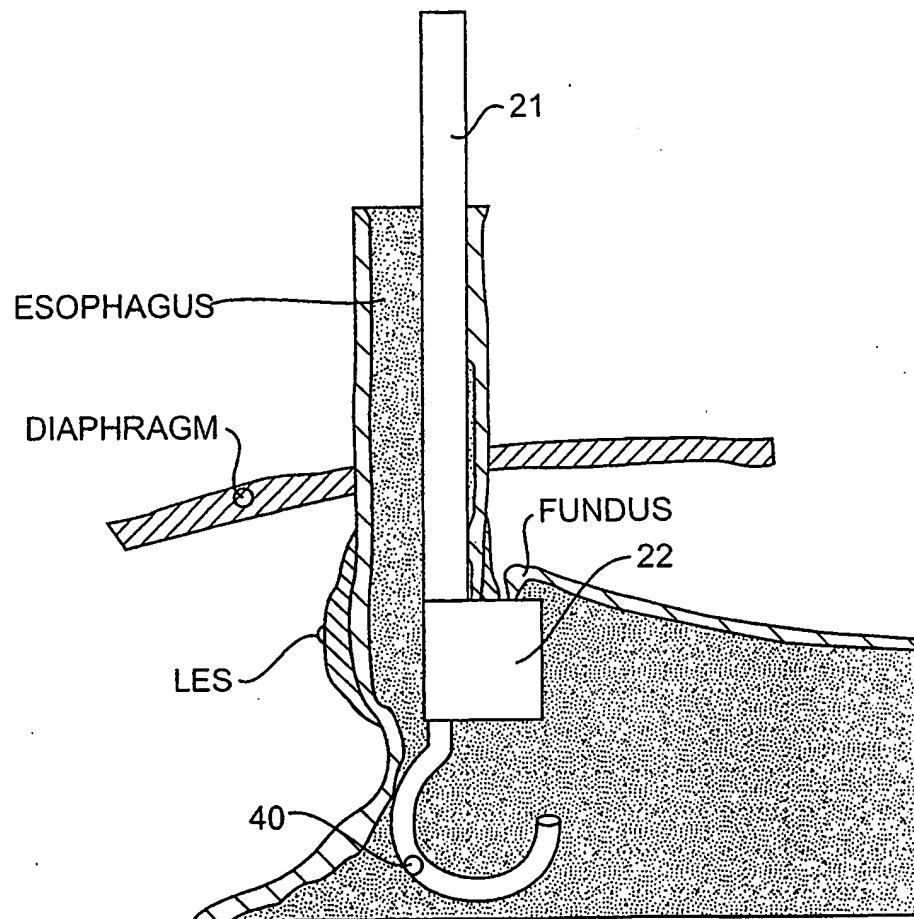
**FIG. 1****FIG. 2**

**FIG. 3A****FIG. 3B****FIG. 3C****FIG. 4****FIG. 5B****FIG. 5A**

3/5

**FIG. 6****FIG. 7**

4/5

**FIG. 8**

5/5

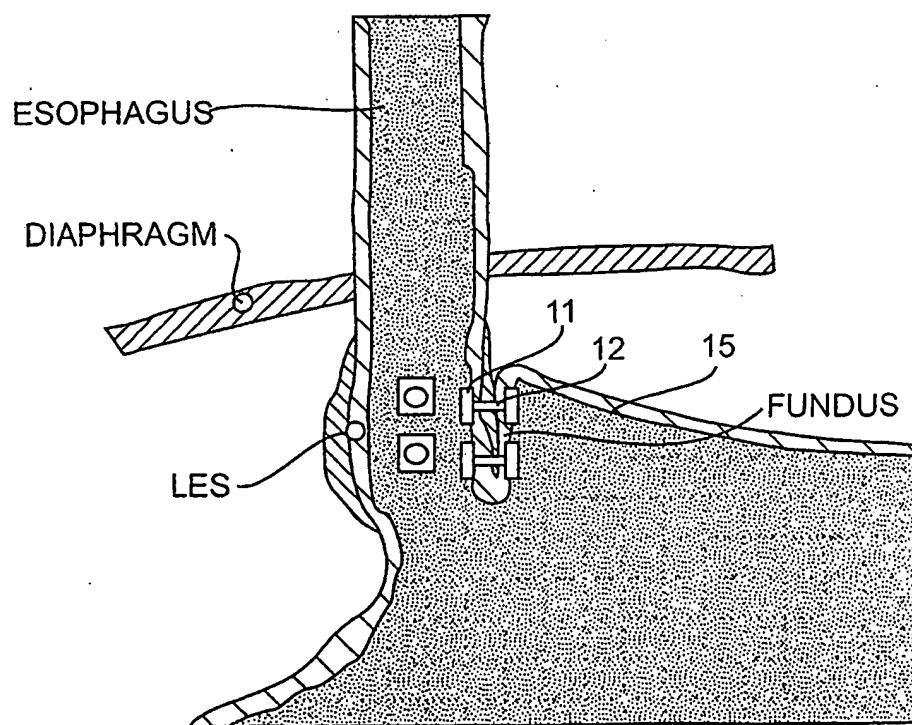


FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US 01/14866

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 A61B17/072 A61B17/064		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) IPC 7 A61B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the International search (name of data base and, where practical, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 344 060 A (GRAVENER ROY ET AL) 6 September 1994 (1994-09-06) column 8, line 54 -column 9, line 38; figures 6,9 figures 10,11	1-7, 9-12,14
Y	---	8,20-22
Y	US 5 403 326 A (FLAKE ALAN W ET AL) 4 April 1995 (1995-04-04) column 2, line 16 - line 31 column 7, line 24 - line 31 column 8, line 24 - line 29; figures 8A-8D figure 9	8,20-22
A	---	1,2,5,7, 9
	-/-	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C.		<input checked="" type="checkbox"/> Patent family members are listed in annex.
* Special categories of cited documents :		
'A' document defining the general state of the art which is not considered to be of particular relevance		'T' later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
'E' earlier document but published on or after the International filing date		'X' document of particular relevance; the claimed Invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
'L' document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		'Y' document of particular relevance; the claimed Invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
'O' document referring to an oral disclosure, use, exhibition or other means		'&' document member of the same patent family
'P' document published prior to the International filing date but later than the priority date claimed		
Date of the actual completion of the International search	Date of mailing of the International search report	
3 September 2001	12/09/2001	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Ducreau, F	

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 01/14866

C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 423 858 A (MASTRI DOMINICK L ET AL) 13 June 1995 (1995-06-13) claims 1,2; figures 7,7A,9,10,11	1-7
X	US 4 573 622 A (GREEN DAVID T ET AL) 4 March 1986 (1986-03-04) column 2, line 29 - line 42; figure 1 figures 9-12	7,9-11, 16,17
A	US 5 676 674 A (BLEWETT JEFFREY J ET AL) 14 October 1997 (1997-10-14) abstract; figures 6A,6B	6,8
A	EP 0 442 588 A (UNIV LONDON) 21 August 1991 (1991-08-21) column 1, line 31 - line 46; figures 1A-1C	20,22

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No	
PCT/US 01/14866	

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5344060 A	06-09-1994	US 5100042 A CA 2037427 A CA 2037427 C DE 69115955 D DE 69115955 T EP 0446012 A		31-03-1992 06-09-1991 05-09-1995 15-02-1996 20-06-1996 11-09-1991
US 5403326 A	04-04-1995	NONE		
US 5423858 A	13-06-1995	NONE		
US 4573622 A	04-03-1986	AU 4532285 A BR 8507002 A CA 1236744 A EP 0197986 A GB 2182277 A,B JP 61501825 T WO 8602256 A		24-04-1986 06-01-1987 17-05-1988 22-10-1986 13-05-1987 28-08-1986 24-04-1986
US 5676674 A	14-10-1997	US 5571116 A US 5897562 A		05-11-1996 27-04-1999
EP 0442588 A	21-08-1991	DE 3584925 A EP 0174843 A GB 2165559 A,B GB 2200072 A,B JP 1921642 C JP 6044913 B JP 61122852 A US 4841888 A US 5037021 A		30-01-1992 19-03-1986 16-04-1986 27-07-1988 07-04-1995 15-06-1994 10-06-1986 27-06-1989 06-08-1991